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Subject: Douglas-fir Beetle Activity in MSO PAC sites within the Rodeo-Chediski Fire (blackmesard)

To: District Ranger, Black Mesa RD

On September 22, 2005, Brian Dykstra, Wildlife Biologist with the Black Mesa RD, and I discussed bark beetle activity in Mexican spotted owl "Protected Activity Centers" (PACs) within the Rodeo-Chediski Fire perimeter. We also discussed methods for assessing the effectiveness of preventive treatments implemented on the District in 2005 to reduce bark beetle attacks within the PACs. I describe in this report past and current bark beetle activity within these PACs, preventive treatments that took place in 2005, and make recommendations for the 2006 season. Additional information on bark beetle biology was provided in a previous report sent to the District on October 30, 2003.

Background information

During my visit to the Black Mesa RD in September 2002, Gayle Richardson (District Silviculturist) and I observed that many mixed conifer trees (Douglas-fir, white fir) were severely damaged by fire within some of the PACs. These trees can be highly susceptible to attack by Douglas-fir beetle, *Dendroctonus pseudotsugae* (Ryan and Amman, 1996). For example, Hood et al. (2003) found in the northern Rockies that Douglas-fir 14 inches dbh and greater with crown scorch greater than 30 percent of the total live crown would have a moderate to high probability of being attached by Douglas-fir beetle within 2 years. Where such susceptible trees are abundant, beetle populations can build up rapidly and spread to adjacent non-damaged stands (Schmitz and Gibson, 1996). There have been several documented cases of Douglas-fir beetle reaching outbreak status following fire scorch damage to Douglas-fir (Schmitz and Gibson, 1996).

Although a formal ground survey was not conducted in 2002, Douglas-fir trees infested with Douglas-fir beetle were found within the burn area. Because of unsuitable survey conditions, we were not able to survey within the boundary of the Rodeo-Chediski Fire in 2002; however, several Douglas-fir mortality polygons were mapped just to the northwest of the fire boundary. Nearly 2,000 acres of Douglas-fir beetle activity was mapped across the Apache-Sitgreaves NF in 2003. Much of this activity occurred below and above the Mogollon Rim near the PAC sites of interest. During a brief ground survey conducted within the Rodeo-Chediski Fire boundary during September of 2003, I found scattered Douglas-fir beetle activity within areas of moderate fire intensity. Rates of Douglas-fir beetle-caused tree mortality have continued to increase throughout the Apache-Sitgreaves NF acres in 2004 and in 2005.

Preventive treatments to reduce Douglas-fir beetle activity

To take a proactive approach to prevent spread of this beetle within and from the burn area, we recommended the deployment of anti-aggregation pheromone for Douglas-fir beetle for 2003. The anti-aggregation pheromone (3-methylcyclohex-2-en-1-one [MCH]) serves to disrupt

aggregation behavior of beetles (Schmitz and Gibson, 1996). MCH is being used operationally to protect localized areas from being attacked by Douglas-fir beetle (Ross and Daterman, 2001.

The Black Mesa RD received Prevention/Suppression funding in the spring of 2003 for the deployment of MCH within the PAC sites. In late April through Mid-May of 2003, our office worked with the Black Mesa RD Wildlife unit to deploy MCH throughout selected PAC sites. Criteria for selecting PAC sites to be treated included percent of Douglas-fir in stand, level of crown and bole damage to Douglas-fir, and previous and current owl activity. MCH was deployed in a grid fashion in which bubble capsules were stapled to trees every 40 feet throughout the area to be protected. The District received additional Prevention/Suppression funds in 2004 & 2005 and the MCH treatments were repeated by early May of each year. The Coconino Rural Environment Corps (CREC) was contracted to put out the MCH with oversight from our office and the District.

Brian Dykstra's staff conducted a thorough ground survey in the PAC sites treated with MCH the last week of August 2004 and 2005. Effectiveness of the project was determined by the use of timber stand examinations and point-to-point transect observations. Stand examinations completed for the project were compliant with the USDA Forest Service Common Stand Exam Field Guide for Region 3. Three stand examination plots were completed in each PAC site. The first plot for each PAC was selected at random with the aid of a GIS system, the second plot in succession was placed 5 chains (330 ft.) from the first plot in a manner that would allow the plot to fall within the PAC. The third plot was placed 5 chains from the second plot in a similar fashion as the second plot. In 2005, the plots were located 10 chains apart.

The surveys were completed by a three person team. Each plot was surveyed for the following parameters: live trees were surveyed on a variable radius plot using a 10 basal area factor (BAF) and a breakpoint diameter of 5 inches DBH, dead trees must be 12 inches DBH and were surveyed on a 1 acre fixed radius plot (118 foot radius from plot center), and regeneration was surveyed on a 11.8 foot fixed radius plot. Two damage categories and agents were selected for each tree, if applicable.

Point-to-point transects consisted of the three person crews tallying the number of dead or dying Douglas-fir within transect. Transects were one chain wide (66 feet) and 5 chains (330 feet) long for a total area surveyed of ½ acre. In 2005, the transects were 10 chains long and therefore a acre in size. Each crew member tallied the number of Douglas-fir encountered that had signs of Douglas-fir beetle attack: pitch tubes, fading foliage, orange frass, and/or beetle life stages (larvae, pupae, adults).

Based on these signs of attack, light (Horse Tank and Jersey Canyon PACs) to a limited level of Douglas-fir mortality occurred within the PAC sites treated with MCH during 2004 (***Table 1***). It should be noted that initial entry/feeding by woodborers can create orange boring dust similar to that created by Douglas-fir beetle. Only after woodborers enter the sapwood does the boring dust become white in color. Therefore, not all of the attacks reported in 2004 were necessarily by Douglas-fir beetle. In addition, based on the protocol used for transects, one cannot determine if these trees were killed initially by fire damage or by Douglas-fir beetle.

Douglas-fir beetle activity in PAC sites in 2005

Suzanne DeRosier, District Wildlife Staff, and I visited some of the MSO PAC sites treated with MCH to determine the level of Douglas-fir beetle activity on September 22, 2005. Based on the transect surveys there was a limited amount of new Douglas-fir mortality within some PACs (***Table 1***). However, none of the inspected Douglas-fir trees that died in 2005 were attacked by Douglas-fir beetle. The recent mortality was evidently caused by a combination previous fire damage, woodborers, and Douglas-fir pole beetle (***Figure 1***). Because no life stages of the woodborers were present, I was not able to identify which species had attacked these trees. During subsequent discussion with entomologists in Rocky Mountains, one possible woodborer responsible for this mortality would be the flatheaded fir borer, *Melanophila drummondii*. This beetle has killed drought-stressed Douglas-fir throughout Idaho and Montana (Furniss and Carolin, 1977). However, based on the larval gallery patterns seen in dying Douglas-fir on the Black Mesa RD, it appears that a different woodborer species was present. As their common name implies, the Douglas-fir pole beetle (*Psuedohylesinus nebulosus*) attacks primarily small diameter live Douglas-fir and the tops of dying larger diameter trees (Furniss and Carolin, 1977). Mortality caused by the unidentified woodborer and Douglas-fir pole beetle are expected to be limited in nature (i.e., not reach outbreak levels).

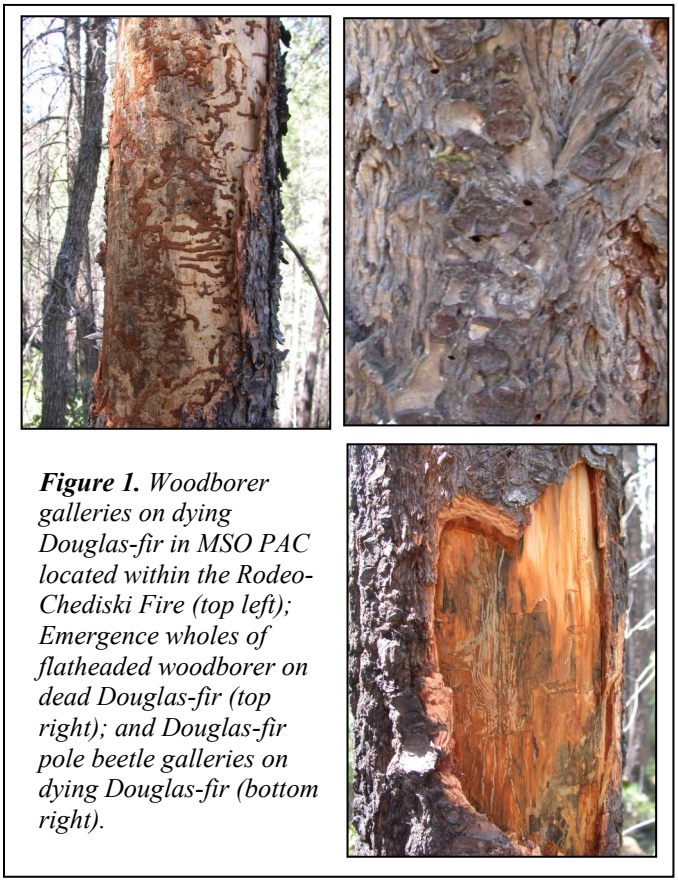

Figure 1. *Woodborer galleries on dying Douglas-fir in MSO PAC located within the Rodeo-Chediski Fire (top left); Emergence wholes of flatheaded woodborer on dead Douglas-fir (top right); and Douglas-fir pole beetle galleries on dying Douglas-fir (bottom right).*

Table 1. *Cumulative Douglas-fir mortality 2002 through 2004 or 2005 in each PAC site treated with MCH based on transect surveys.*

	DFB Attacks/Transect (mean)	
PAC Site	**Through 2004**	**Through 2005**
Horse Tank 1A	0	6
Horse Tank 1B	1	5.5
Jersey Canyon 2A	5	--
Cemetery	26	27
Big Canyon	--	1
Twin Lakes	--	3
Hangman	--	6
Total	**8.0**	**8.1**

Douglas-fir beetle flight periodicity

Because no data existed for Douglas-fir beetle flight periods in Arizona, we began monitoring flight periodicity of beetles in 2004 and continued this in 2005. Bark beetle flight periodicity is typically measured using Lindgren® funnel traps bait with beetle specific lures (Lindgren, 1983). Therefore, six 12-unit Lindgren® multiple-funnel traps were deployed each year in three pairs within the boundary of the Rodeo-Chediski Fire south of Highway 260, but outside of the any PAC site by more than 1/2 mile. Traps were baited with a commercially available Douglas-fir beetle lures. Beetles were collected from traps either weekly or every other week beginning in mid-April through early-September. Initial Douglas-fir beetle flight in 2004 occurred between May 27th and June 3rd based on visual inspection of trap catches. A total of 11,000 beetles were trapped in 2004 with a peak of more than 60 beetles caught per day in late June. Douglas-fir beetle flight appeared to be completed by the late August. In 2005 the beetles appeared to initiate flight slightly earlier as relatively large numbers of beetles were found at the first collection date of June 8th. Although we have not completed counting all of the collected beetles for 2005, large numbers of beetles are still being caught. Although additional years of flight monitoring are needed to account for year to year variability, the first two years of findings suggest that MCH treatments should be in place by the middle of May. Furthermore, surveys designed to find newly attacked Douglas-fir can begin by early September.

Recommendations for FY2006

Based on the level of Douglas-fir beetle activity around the PAC sites of interest within the Rodeo-Chediski Fire perimeter, I recommend that the PAC sites be treated with MCH again in 2006. If possible, the MCH should be deployed no later than early May. I will continue to work with Brian, his staff, and the CREC crew to purchase and set out the MCH. I recommend that we have a thorough discussion and training of identifying Douglas-fir beetle attacks prior to conducting the post-treatment surveys.

Funds may be available for FY2006 from Forest Health Protection for preventing Douglas-fir beetle populations from increasing within the PAC sites on the District. Requests for these funds should be in no later than October 15, 2005.

If you have any questions regarding this assessment of the current beetle activity within the PAC sites, please let us know. I can be reached at (928) 556-2074.

/s/ Joel D. Mcmillin
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